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Mammoth *(E. primigenius)* and Mastodon *(M. giganteus)* Restored.

O. T. Mason

MASTODON,

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MAMMOTH,

AND

MAN.

BY

J. P. MACLEAN,

AUTHOR OF "A MANUAL OF THE ANTIQUITY OF MAN."

WITH ILLUSTRATIONS.

SECOND EDITION.

CINCINNATI:
ROBERT CLARKE & CO.
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PREFACE.

The interest awakened by the discoveries and conclusions of the working geologist is increasing every year. Many of the facts which would be acceptable to general readers are placed beyond their reach, being recorded only in technical works or else in the memoirs of learned societies. The compiler of this little book believes that a work of this kind will be welcomed by the multitude. It is a subject which must needs be of general interest. The usual hand-books on geology give but a meagre account of these colossal proboscidians, which serve only to arouse an interest without being able to gratify it.

In tracing out the evidences of the co-existence of man with the mammoth and mastodon, it is not attempted to prove the great antiquity of man. The compiler has already done that in another work, entitled "A Manual of the Antiquity of Man."

In the preparation of this work I have relied principally on Dr. J. C. Warren's "Mastodon Giganteus," and have freely used Lyell's "Principles of Geology," Mantell's "Wonders of Geology" and "Fossils of the British Museum," Meunier's "Life in the Primeval World," "The American Naturalist," Foster's "Pre-Historic Races," Figuier's "World Before the Deluge," Leidy's "Extinct Vertebate Fauna of the Western Territories," Lieut. Wheeler's Report of Surveys West of 100th Meridian, Vol. IV; Southall's "Epoch of the Mammoth," besides quite a number of other works.

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PART FIRST.

THE MASTODON.

PART I.

THE MASTODON.

I. GENERAL DESCRIPTION.

"Built high and wide, his solid bones surpass
The bars of steel; his ribs are ribs of brass;
His port majestic and his armed jaw
Give the wide forest and the mountain, law.
Earth sinks beneath him as he moves along
To seek the herbs, and mingle with the throng.
See with what strength his hardened loins are bound,
All over proof, and shut against a wound!"

This description of the behemoth of the book of Job, as given by Dr. Young, may very properly be applied to the mastodon which once roamed through the primeval forests of America, and certain parts of Europe and Asia. We know it only from its remains, which have been found in various localities. Language is insufficient to give an adequate idea of the grandeur and massiveness of the complete skeleton. It towers far above the animals with which we are so familiar; and even the elephant, although nearly of the same height, has a frame which may be called delicate in comparison. It belonged to the elephantine family, though, in many respects, differing from the living specimens. It was not superior to the elephant in height, but its limbs were thicker, the abdomen slenderer, the length greater, and the head more massive and longer.

The tusks were four in number, and those of the upper jaw curved upwards, and sometimes attained the length of twelve or thirteen feet. Besides the regular intermaxillary tusks, in one species at least, there are two very small ones which make their appearance at the very earliest period of life, but shortly give way for the permanent ones. As has been already stated, two tusks make their appearance in the lower jaw, only one of which became developed, that in the adult male; both were early shed in the female. These tusks form one of the distinctive characteristics which separate the mastodon from the elephant. The structure of the teeth also constitutes a very important part in the anatomical description, and widely differs from those of the rest of the elephant family. While there are certain varieties of the mastodon which are easily separated into distinct groups, yet there are others not so well marked, belonging to the transitional rank between the mastodon type and the elephant type.

II. HISTORY.

The first authentic history of the discovery of the remains of the mastodon dates back to the year 1613. Near the castle of Chaumont, in Dauphine (France), some bones were found in a sand-pit, which were purchased by a surgeon named Mazuya, who pretended that he had discovered them in a brick tomb, thirty feet long by fifteen broad, inscribed with the name of *Teutobocchus Rex*, a chief of the Cimbri (Northern Germany), who was defeated by the Roman commander, Caius Marius, 102 B. C. He also claimed to have found in the same tomb fifty medals bearing the effigy of Marius. Mazuya exhibited this skeleton in the cities of France and Germany. Riolan, an anatomist, after having examined the bones of the pretended king, pronounced them to be those of an elephant. This gave rise to an animated controversy in which numerous

Figure 2.

The Mastodon Restored.

pamphlets were exchanged on the subject. In the year 1832 the skeleton was removed from Bordeaux to the Museum of Natural History in Paris, where De Blainville recognized it as belonging to the mastodon.

The gigantic bones discovered in 1705, thirty miles south of Albany, New York, were regarded as additional proof of the ancient stories relative to the past existence of a race of giants. One of the teeth was shown to Governor Dudley, of Massachusetts, who was "perfectly of opinion that the tooth will agree only to a human body, for whom the flood only could prepare a funeral; and without doubt he waded as long as he could keep his head above the clouds, but must, at length, be confounded with all other creatures." * The bones of the mastodon found near Santa Fe' de Bogota, in the "Field of Giants," were formerly taken for human remains. And, in like manner, the great quantity of bones of this animal found in the Cordilleras originated the Spanish tradition that Peru was formerly inhabited by men of colossal stature.

The mastodon first attracted the attention of the scientific men of Europe about the middle of the last century. M. de Longueil, a French officer, in 1739, while traversing the forests bordering on the Ohio River, discovered in Kentucky some bones, which, on account of their magnitude, excited his curiosity to such an extent that he carried them along with him, and on his return to France presented them to D'Aubenton and Buffon. It is worthy of notice that these were the first relics of the mastodon which received the attention of the scientific men of Europe, and also the first taken thither. D'Aubenton ascribed the thigh-bone and tusk to the elephant, but attributed the teeth to the hippopotamus. On the other hand, Buffon declared that the teeth as well as the tusk and thigh-bone belonged to an elephant which had existed in the primitive ages

* Extract from Governor Dudley's letter to Cotton Mather.

of the world. He regarded it as having been from four to six times the size of the existing elephant; an estimate he was led to make by supposing that all the teeth, instead of springing up in succession, existed in a continuous row.

The discovery of these remains not only produced a profound impression in Europe, but caused naturalists to entertain the fundamental idea that extinct species of animals were exclusively peculiar to the ancient ages of the world. It also quickened an interest in searching for these remains, and when, in 1763, the English became masters of Canada, they sought eagerly to obtain them. In 1767, Crogan, the geographer, having traversed the region of the Ohio, sent many cases of these relics to London, addressing them to different naturalists. About a mile and a half from the Ohio, in the State of Kentucky, he found in a salt-marsh six immense skeletons interred upright. A femoral bone of one of these skeletons weighed one hundred pounds, being four feet and a quarter in length. The reception of these bones in Europe quickened the interest already manifested, and which has never ceased; and so prominent has it been that up to the present time more than forty eminent naturalists have written particularly on the subject.

Upon the theory advanced by Dr. Hunter that the mastodon was carnivorous, Goldsmith, in his "Animated Nature," concludes his remarks as follows, which are amusing under our present knowledge: "As yet this formidable creature has evaded our search; and, if indeed, such an animal exists, it is happy for man that it keeps at a distance; since what ravage might not be expected from a creature, endued with more than the strength of the elephant, and all the rapacity of the tiger!"

Cuvier gave the subject his careful attention, and to him we are indebted for the first elaborate account of the bones of the *Mastodon Giganteus*. He did not have the ad-

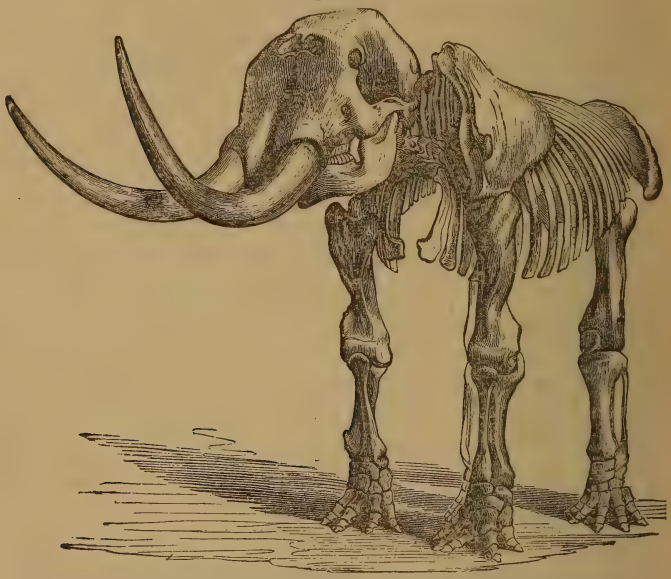
vantage of a complete skeleton, for only fragments or parts were known until 1801. In that year Charles W. Peale, after much persevering labor, produced one nearly complete from the morasses of Orange county, New York. His son, Rembrandt Peale, published, in London, in 1803, a description of this skeleton, in a pamphlet of ninety-one pages, with the title, "An Historical Disquisition on the Mammoth, or, Great American Incognitum, an Extinct, Immense, Carnivorous Animal, whose Fossil Remains have been found in North America." This skeleton occupied a prominent place in Peale's Museum at Philadelphia, until 1849, when it suddenly disappeared. It is believed to have fallen into the hands of Professor Kaup, of Darmstadt, Germany. (For description see Appendix).

In the year 1840, Dr. Albert Koch discovered a skeleton of the mastodon in Benton county, Missouri, near the banks of the Pomme-de-Terre River, about ten miles above its junction with the Osage. The bones were imbedded in a brown sandy deposit full of vegetable matter, with recognizable remains of the cypress, tropical cane, and swamp moss, stems of the palmetto, etc., and this covered by beds of blue clay and gravel to a thickness of about fifteen feet. Dr. P. R. Hoy * claims to have visited the spot very soon after this discovery had been made, and declares the excavation to have been fifteen feet in diameter and six feet in depth, and the skeleton was struck upon at a depth of two feet. Dr. Hoy's statement, which was written to disprove that of Dr. Koch, would force the skeleton into a space of only four feet in depth, which supposition is only admissible by presuming that the skeleton had been broken up and afterwards washed there. Out of the bones of this skeleton, together with many belonging to other individuals, Dr. Koch constructed an enormous osteological monster, and named it

* "American Naturalist," Vol. V.

the "*Missourium*, or *Leviathan* of the Missouri." This he placed on exhibition in London, and soon afterwards sold it to the Trustees of the British Museum, where it was overhauled and properly mounted by Professor Owen. An illustration of this skeleton, as it appeared in the

Figure 3.



Skeleton of the Mastodon Giganteus from Missouri, now in the British Museum.

Museum, is given in Fig. 3. It has been suggested that the two scapulæ now forming a part of this skeleton, and the two detached ones, are in reality the bones of the mammoth; and Dr. Koch may have dug up the remains of both these animals from the same deposit.

The skeleton so minutely described by Dr. J. C. Warren, in his work entitled "Mastodon Giganteus," was discovered near Newburgh, New York, in the summer of 1845. The spot where the skeleton was found is situated in a small

swampy valley, where animals were not infrequently entrapped and mired. The summer of 1845 had been unusually dry; many small lacustrine deposits were exposed to the drouth, which afforded the farmers an opportunity for removing their contents to fertilize the neighboring fields. While some laborers were removing the contents of this small valley they struck upon the skull of the mastodon. At once they suspected what it was, and then proceeded with great care until the whole of the skeleton had been obtained, with the exception of a portion of the sternum, a few bones of the feet, and a number of the caudal vertebræ, some of which were recovered afterwards. The animal evidently had been mired, for the anterior extremities were extended under and in front of the head, as if the animal had stretched out its arms in a forward direction in order to extricate itself, and the posterior extremities were extended forward under the body. In this morass, scarcely covered by the soil and a few feet of water, this animal had remained undisturbed by any intrusion for unknown ages. The bones were in an almost perfect state of preservation. Mastodon bones, when discovered, are usually black, but these were of a brown color, like those of a recent human skeleton, which had been in use a considerable length of time. The bones after having been cleansed and dried, were articulated by Dr. Prime, and afterwards exhibited in New York and a number of New England towns, and then, came into the possession of Dr. Warren. As the skeleton was not properly put together, Dr. Warren secured the services of Dr. Shurtleff, who disarticulated and re-arranged the bones—a work which was successfully completed after an unremitting labor of four weeks. (For description see Appendix).

III. NAME.

When the bones of the mastodon were first discovered in quantity they were supposed to belong to the same ani-

mal as the fossil elephant of Siberia, and for a long time it was called the mammoth. It also received the name of "The Great American Incognitum." Its present name was given to it by Cuvier, who designated it by the form of the tooth—the word *mastodon* being derived from the two Greek words, *mastos*, *nipple*, and *odous*, *tooth*, or nipple-tooth. Dr. William Hunter, having been misled by a partial view of the organization of the teeth and their apparent similarity to the teeth of the carnivora, was of opinion that the points of these massive organs were destined to crush the bones of smaller animals, hence he called it the "Carnivorous Elephant." The mastodon of North America having been the first to receive attention, to it Cuvier added the specific term *Giganteus*, or "Gigantic Mastodon." The remains were found bordering on the Ohio, and on this account Buffon called it the *Mastodon Ohioticus*. In 1793 Pennant designated it by the name of *Elephas Americanus*, or American Elephant; Blumenbach, in 1797, named it *Mammut Ohioticum*, or the Mammoth of Ohio; Adrian Camper proposed naming it *Elephas Macrocephalus*, or Long-headed Elephant. As the epithet *Ohioticum* was used before *Giganteus*, Dr. Falconer favored the former term. It has also been called *Mastodon Magnum*, or Great Mastodon. It seems that the name Mastodon Giganteus should be given to the principal American species, for, of all the different varieties, it is the largest, and this name very appropriately designates it.

IV. RANGE.

No extinct quadruped has been more widely diffused over the globe than the mastodon. It has extended from the tropics both south and north into temperate latitudes, and its bones have been found in vast numbers throughout the plains of North America, from north of Lake Erie to the Gulf on the south. There were mastodons peculiar to

Central and South America, and still other varieties have been discovered in England, France, Switzerland, Germany, Spain, Italy, Greece, in Asia Minor, and in several parts of India.

It is a little remarkable that scarcely any remains have been found east of the Hudson, and none east of the Connecticut River. Some bones have been found near New Britain, and two teeth thirteen miles north of New Haven. But these are exceptional instances. There certainly must have been some reasons why the mastodon did not choose to penetrate the woods of New England. It may have been that the Hudson served as a partial barrier to its passage farther east; and, besides, the climate may have been less desirable than the milder regions of the South and West, or a particular kind of vegetation may have been wanting which it fed upon. Stragglers or small troops penetrated into Canada, but the probability is that these relics, which occur outside the natural range, only prove the disposition of the animal to wander.

A vast number of bones have been collected in New York, Ohio, Kentucky, Virginia, the Carolinas, Alabama, Mississippi, Missouri, California, and Oregon. The most celebrated locality is Big Bone Lick in Kentucky. This marsh is about twenty-three miles below Cincinnati, about four miles from the Ohio, and nearly opposite the mouth of the Great Miami, and situated in a nearly level plain, in a valley bounded by gentle slopes. The general course of the stream, which meanders through this plain, is from east to west. The bog is many acres in extent, but was much larger before the surrounding forest was cleared away. The greater number of the bones have been taken from the black mud, about twelve feet below the level of the creek. The bones belonging to more than one hundred mastodons have been found there, besides about twenty-five of the mammoth, some of the megalonyx, and

a species of the stag, bison, and horse. The greatest depth of the mud has never been ascertained; it is composed chiefly of clay, with a mixture of calcareous matter and sand, and sulphate of lime with some animal matter. At various depths layers of gravel occur. In speaking of this locality, Sir Charles Lyell says, in his "Travels in North America": "There are two buffalo paths or trails still extant in the woods, and both lead directly to springs: the one which strikes off in a northerly direction from the Gum Lick, may be traced eastward through the forest for several miles. It is three or four yards wide, and only partially overgrown with grass, and sixty years ago was as bare, hard, and well-trodden, as a high road. It is well known that during great drouths in the Pampas of South America, the horses, deer, and cattle throng to the rivers in such numbers that the foremost of the crowd are pushed into the stream by the pressure of others behind, and are sometimes carried away by thousands, and drowned. In their eagerness to drink the saline waters and lick the salt, the heavy mastodons and elephants seem in like manner to have pressed upon each other, and sunk in the soft quagmires of Kentucky."

V. CONDITION OF THE BONES.

The bones have been found in various conditions, some being almost perfect and others crumbling on being handled. In Europe the bones are more fragmentary and are rarely met with. This is due to their greater antiquity, for it is well established that the American variety continued to flourish long after the European mastodon had become extinct. Many causes have operated in the preservation of these remains, among which are the solutions of lime, silex, and iron. The bones of the *mastodon giganteus* are scarcely ever found in a mineralized condition, and the preservation in many instances is due to silex. The preservation is also often due to their immersion in water to

such a depth as to prevent the contact of air, and in other cases are protected by superincumbent earth which resists the tendency to decomposition. In the salt-licks it is due to their having been impregnated with the chloride of sodium, which has a greater power of preventing decomposition than ordinary soil.

Dr. C. T. Jackson made an analysis of a portion of the vertebral bone of the Newburgh skeleton, after being dried at 300° Fahr., with the following result:

"Animal matter (bone cartilage)	27.73
Bone earth (phosphate and carbonate of lime) and phosphate of iron	72.27
	100.00

"A portion of the bone with cancelli yielded, by drying, at a little above 212° Fahr.

Water	6
Bone earth (phosphate and carbonate of lime) and phosphate of iron	64
Bone cartilage	30
	100

"On burning the bone, the ash which remains is of a beautiful blue color, owing to the presence of phosphate of iron, which appears to have been infiltrated into the bone from the marl surrounding the skeleton."

One of the skeletons found in Wythe county, Virginia, preserved the outlines of its trunk, and another in Illinois, the fleshy part of the mouth in a tolerably good condition.

VI. THE TEETH.

The vast number of teeth which have been discovered in a good state of preservation, received early attention, and their structure and form have aided very materially in assigning to the mastodon its true position in the economy of nature. The teeth are nearly rectangular in form, and present, on the surface of their crown, great conical

tuberosities or processes with rounded points, disposed in pairs to the number of four or five, according to the species. An illustration of the grinding tooth of the *M. giganteus* is given in Figure 4.

Figure 4.

Grinding Tooth of the M. Giganteus.

The teeth are composed of dentine and enamel, the latter being spread over the crown of the tooth, and the transverse ridges not filled up with cement as in the elephant. The teeth have no relation whatever to the carnivora; for, although having an external covering of enamel, they are destitute of the longitudinal, serrated cutting edge, as exhibited in the flesh-eaters, and by use the protuberances become truncated into a lozenge form. The whole structure of the teeth fitted them for the grinding and mastication of tough and hard vegetable substances. The number of the teeth, in some species, was six on each side of each jaw, making in all twenty-four. They did not all appear at the same time, but were developed in succession, in proportion to the waste of those which preceded. The upper teeth are a little wider than the lower. The first three are wider behind than in front; the two next, square, and the last terminates in a blunt point. Eight deciduous, or milk teeth, two on each side of each jaw, are developed soon after birth, and shed at an early period. Soon after these teeth make their appearance, a third deciduous tooth is produced, somewhat larger and more complicated, constituting the first three ridged, six-pointed molar; then follows a fourth of the same form as the third, though greater in size. Sometimes these four teeth in each side of each jaw, sixteen in all, are found co-existing. Following the fourth tooth a fifth is devel-

oped, still larger in size. Before the appearance of the fifth, and in most cases before the fourth shows itself, one or more of the first teeth have disappeared. The sixth and last tooth, which occupies the whole side of the jaw, is much larger and different from any of the others. It is about ten inches in length, four in breadth, twenty inches around the neck, and weighing from ten to twelve pounds. The crown is divided into four or five ridges, with its eight or ten points and furrows more deeply cleft than in the other teeth, and the ridges larger and broader. A supplementary, or seventh tooth, was discovered in Michigan in 1854. It has the general characteristics of the fifth tooth of the *M. giganteus*.

This succession of teeth was necessary, because the animal required great quantities of food, and the prodigious labor imposed upon the molars could only have resulted in impairing the tooth, and the molar, thus employed in crushing and bruising the coarse vegetable substances, gradually wore out both in thickness and length. During this wearing and wasting away, another is developed, which pushes the active tooth before, in the direction of the length of the jaw. By this method the old root is broken and soon the tooth gives way, making room for the newer and stronger one.

It should be noted that in the *M. angustidens* and *M. longirostris* there is an additional pre-molar tooth situated at the root of the second milk-tooth.

VII. FOOD.

The contents of the stomach of the Newburgh mastodon were described by Dr. Prime, as follows: "In the midst of the ribs, embedded in the marl and unmixed with shells or carbonate of lime, was a mass of matter composed principally of the twigs of trees broken into pieces of about two inches in length, and varying in size from very small

twigs to half an inch in diameter. There was mixed with these a large quantity of finer vegetable substance, like finely divided leaves; the whole amounting from four to six bushels. From the appearance of this, and its situation, it was supposed to be the contents of the stomach; and this opinion was confirmed on removing the pelvis, underneath which, in the direction of the last of the intestines, was a train of the same material, about three feet in length and four inches in diameter. A portion of this was examined under the microscope by Professor Gray who concluded that the 'woody matter consisted of twigs of some corniferous tree or shrub, and probably of some kind of spruce or fir.'"

Immediately around and beneath the bones of the mastodon found near Goshen, New York, was a stratum of coarse vegetable stems and films resembling chopped straw, or rather the drift stuff of the sea; for in it were broken fibres of conferva (algæ, or water-plant), like those of the Atlantic shore.

The skeleton discovered in Wythe county, Virginia, at a depth of six feet, and resting on a bed of limestone, contained, according to Bishop Madison, in the middle of the bones a partly masticated ball of small twigs, grasses, and leaves, among which was recognized a kind of reed still common in Virginia, and the whole was enveloped in a kind of sac which was undoubtedly the stomach of the animal.

There is every evidence then to show that the mastodon was a vegetable feeder, and subsisted on the coarse as well as the tender branches of trees, with their leaves, on rushes and other aquatic plants. It has been conjectured that one reason why they lived along the banks of the rivers was to avail themselves of the roots of trees which grew along the edges or borders of the marshes, and which could be easily dug up or pried out by the tusks. Some

varieties may have partially subsisted on the succulent roots of certain trees, but there is very strong evidence that all did not do so, nor even upon the shorter grasses. The mastodon of Mt. Pentelicus could not conveniently have touched the earth with its trunk, owing to its long symphysis and tusks, thus being forced to find its nourishment at a certain distance from the ground. If analogy alone is to be considered, it might be concluded, judging from the shape of the head of several varieties, that the mastodon never fed upon roots. Although their teeth were adapted for crushing hard substances, and masticating the roots of trees, yet the hippopotamus, with teeth somewhat similar, never feeds upon roots, but exclusively on reeds and herbs.

VIII. HAIR.

Were we to judge alone from the northern region where this animal has been found, and the food upon which it subsisted, we would be forced to conclude that it was covered with hair. It is well known that the living elephant is almost hairless, and yet the elephants of India which live on elevated and cool districts are more hairy than those of the lowlands; that the heat causes these animals to be hairless, and in such districts where a covering is needed it is supplied. Were it probable that the mastodon lived in the northern part of the country in summer only, and retreated to the south in winter, and the climate not having perceptibly changed since it became extinct, the cool nights and sudden changes in the weather would demand that a covering of hair should be supplied. However, this question has not been left to conjecture, for the hair has been found. Around and in the immediate vicinity of the skeleton found at Scotchtown, Orange county, New York, were locks and tufts of hair, of a dun-brown, from an inch and a half to seven inches in length. In

Montgomery county, same State, the hair was found of a dun color, and three inches long. Both skin and hair accompanied the bones found sixty feet beneath the surface, near the entrance of the Wabash River into the Ohio.

IX. DIFFERENT SPECIES.

The number of the varieties of the mastodon have been variously given by authors, from four to thirty, owing to the differences which each thought should constitute a distinct species. Many of these differences are not based upon the comparisons of skeletons, but upon some slight modification of a tooth. The wisdom of attempting to found a new species upon some slight variation of a tooth, or some other member, is to be doubted. The slight modification of a tooth of any well marked family is an uncertain guide. A writer in the *Dental Cosmos* cites statistics showing that the wisdom tooth in man is being gradually lost; that "of three hundred and twelve persons over twenty-six years of age, fifty-two had none at all; forty-four had deficiencies in upper and lower; seventy-six had deficiencies in upper only; thirty-two had deficiencies in lower only; twenty-one with deficiencies were over fifty years of age. In three hundred and twelve persons, three hundred and four wisdom teeth were absent." It would be folly in such cases to assign these people to a new species of mankind. The compiler of this work still retains the second of the two temporary molars of the right side of the lower jaw, and, hence, never had the second bicuspid. On consulting one of the best informed dentists, concerning this tooth, he was assured that such was not uncommon. Upon the plan, adopted by some comparative anatomists, those of us having only three bicuspids in the lower jaw, then, must be assigned to a "different and well marked species of mankind."

In the following list of the different varieties of the mastodon an attempt is made to explain the meaning of the

NAME.	EXPLANATION.	EPOCH.	LOCALITY.
Mastodon Angustidens (Cuvier)	Narrow-tooth Mastodon	{ Miocene { Pliocene	England. France.
" Longirostris (Kaup)	Long-nose "	Miocene	Europe.
" Tapiroides (Cuvier)	Tapir-like "	"	France.
" Latidens (Clift)	Broad-tooth "	"	India.
" Perimensis	Extinct "	"	India.
" Sivalensis {Falconer / Cautley}	Sivalik "	"	India.
" Elephantoides (Clift)	Elephant-like "	"	Ava.
" Pyrenaicus (Lartet)	Mastodon of the Pyrenees	"	Spain.
" Cuvieri	" " Cuvier	"	Europe.
" Productus (Cope)	Long Mastodon	"	New Mexico.
" Obscurus (Leidy)	Obscure "	"	Maryland.
" Arvernensis {Croizet / Jobert}	Mastodon of Auvergne	Pliocene	France.
" Andium (Cuvier)	Mastodon of the Andes	"	Buenos Ayres.
" Humboldtius (De Blainville)	" " Humboldt	"	Andes.
" Turicensis	" " Turin	"	Turin.
" Borsoni (Hays)	" " Borson	"	Europe.
" Buffonis	" " Buffon	"	Europe.
" Campester (Cope)	" " Plain	"	Kansas.
" Brevirostris (Gervais)	Short-nose Mastodon	"	France.
" Mirificus (Leidy)	Strange "	"	Nebraska.
" Shepardi (Leidy)	Mastodon of Shepard	"	California.
" Pentelici (Gaudry)	" of Mt. Pentelicus	Tertiary	Greece.
" Proavus (Cope)	Ancestor of Mastodon	" (?)	United States.
" Australis	Mastodon of Australia	" (?)	Australia.
" Chapmani (Hays)	" of Chapman	Uncertain	United States.

NAME.	EXPLANATION.	EPOCH.	LOCALITY.
Mastodon Minutus, or Minor	Lesser Mastodon		
" Intermedius	Intermediate Mastodon		
" Dubius	Doubtful "		
" Giganteus (Cuvier)	Gigantic "	Alluvial	United States.
" Jeffersonii	Mastodon of Jefferson	"	"
" Godmanii	" of Godman	"	"
" Collinsonii	" of Collinson	"	"
" Tetracaulodon (Godman)	Four-member tooth	"	"
" " Kochii	T. Mastodon of Koch	"	Missouri.
" " Osagii	" " of the Osage	"	United States.
" " Haysii	" " of Hays	Pliocene	
" " Bucklandi	" " of Buckland		
" " Tapiroides	" Tapir-like Mastodon		

various names, the scientists who bestowed these names, the epoch to which each belonged, and the locality where found. It will be noticed that the names of discoverers, or those prominent in describing the remains, have been given to several.

Dr. Falconer has divided the European mastodon into two groups, having reference to their teeth, viz: Trilophodon (three-ridge tooth), and Tetralophodon (four-ridge tooth). The noted varieties of the first are the *Borsoni*, *tapiroides*, *angustidens*, *and Pyrenaicus;* to the second he assigns seven species, the most noted are *longirostris* and *arvernensis*. To this may be added the American varieties, *obscurus*, *mirificus*, *Shepardi*, and *proavus*. Intermediate between the two groups is the *M. Pentelici;* for, like the first, its second molar tooth is marked by three ridges, and like the second it has four ridges on its third milk-molar.

It is doubtful if the minute division, above given, will assist in the advancement of this study. This list, however, must be cut down. It has been positively decided that the *tetracaulodon* is the male of the *M. giganteus*. This at once strikes from the list the *T. tapiroides*, *T. Osagii*, *T. Kochii*, *T. Haysii*, and *T. Bucklandii*. This list is still further reduced, because the *M. Jeffersonii*, *Godmanii*, *Collinsonii*, and *Chapmanii*, have also been assigned to the *M. giganteus*.

It would be foreign to the object of this work to enter into the minute details which characterize the different species, or to determine which, of the remaining list, should not be classed separately, for any pretension to decide the actual number would be undertaking a task which the ablest palæontolologists have seen fit to leave in a state of uncertainty. An attempt, however, will here be made to briefly trace out the general characteristics of some of these varieties.

1. *M. Giganteus.* This variety (sometimes called *M. Americanus*) has been sufficiently described in what has already been said, for it has been taken as the predominant type.

2. *M. Tapiroides.* This variety is named from its supposed resemblance to the tapir, and approaches nearer the *M. giganteus* than to any other species. Cuvier named it from a single tooth found near Orleans, France; other teeth have been found in various places. Its peculiarity consists principally in the formation of the prominences of the molar-teeth, but being less notched than in the *M. giganteus.* This species is said to form the connecting link between the *M. giganteus* and the *Dinotherium.*

3. Mastodons of South America. Two species are found in South America: the *M. Humboldtius* and *M. Andium;* both being considered by Cuvier, De Blainville, Owen, and others, as referable to the *M. angustidens,* or narrow-tooth group. The *M. Humboldtius* was named from the celebrated traveler, who discovered it. It has a shorter jaw than the *M. Andium,* and the folds of the enamel are more complicated than in the teeth of the *M. giganteus.* It is also found in New Mexico. The *M. Andium* is a smaller species, having the same undulating folds of enamel as the other, but a more elongated symphysis. It also occurs in Central America.

4. *M. Angustidens.* This name was given by Cuvier to mastodons having narrower teeth than the *M. giganteus.* There is considerable dispute about this species, some authors including under this group all the narrow-toothed mastodons, while others number several species. Passing over these disputes, its chief distinction may be said to be that the two ultimate molars in the lower jaw have both four ridges, and the horizontal branch in front of the molars forms a long horizontal semi-canal, slightly inclined downwards. Some anatomists point out other distinctions in the skeleton. To this the *M. Turicensis* is closely allied.

5. *M. Longirostris.* According to some authors this variety is not to be distinguished from the *M. angustidens.* Professor Kaup, who has given it particular attention, thus distinguishes it: "1st, By the length of the lower jaw; 2d, by the existence of four ridges in the third, fourth, and fifth teeth; 3d, by the existence of five ridges in the ultimate tooth; 4th, by the presence of tusks in the lower jaw; 5th, by a vertical premolar; and by various other points." Dr. Falconer considers the *M. angustidens* and *M. longirostris* to be perfectly distinct, and the former to be more nearly related by a three-ridged penultimate molar to the *M. giganteus* than to the *M. longirostris.*

6. M. Arvernensis. The *M. Arvernensis* discovered in the south of France by Croizet and Jobert, in 1828, is placed under the head of *M. longirostris* by Kaup, who believed it to be the young of that species. M. Laurillard believed it to be the *M. angustidens.* It is characterized, according to De Blainville, by a greater number of mammillary eminences than other species, and by a talon in front as well as behind.

7. M. Sivalensis. This, from the Sivalik Hills, India, established by Dr. Falconer and Captain Cautley, has teeth of very large size, the ultimate molars being from eight to nine and one-half inches in length, and about three and one-half inches in width, with six ridges in the upper jaw, rounded protruberances, and rather narrow form.

8. M. Latidens. This was found on the banks of the Irrawaddy, and so named by Clift, on account of the breadth of the tooth. The teeth, for the most part, are broader than those of other species, and sometimes has as many as ten ridges and a talon. This species, and the one called *M. elephantoides,* form two of the links connecting the mastodon with the elephant.

9. M. Cuvier. This one is not clearly made out, but its prolonged lower jaw and the three penultimate molars with three ridges have been particularized.

10. M. Buffonis. This is characterized by short teeth.

11. M. Brevirostris. The *M. Brevirostris* has a short lower jaw, the lower tusks wanting, and the molar similar to *M. longirostris*, with secondary tubercles between the ridges.

12. M. Productus. *M. Productus* belongs to that class of the genus in which the transverse valleys are interrupted by tubercles or cones.

13. M. Obscurus. This species rests upon the tooth known as the "Baltimore tooth," discovered in Caroline County, Maryland, in 1840. The tooth bears some resemblance to the last inferior molar of *M. productus*, but narrower, and displaying a stronger tendency to alternation, and less tubercular.

14. M. Shepardi. Dr. Leidy thinks it probable that *M. Shepardi* and *M. obscurus* belong to one and the same species. *M. Shepardi* was discovered in California by Dr. L. G. Gates, who sent the specimens to Professor C. U. Shepard, of Amherst, Massachusetts, who in turn sent them to Dr. Leidy. The last named it in honor of Professor Shepard.

15. M. Campester. This is a species recently discovered by R. S. Hill, in the Loup Fork beds of Kansas and named by Professor Cope. It belongs to the tetralophodon type, and is somewhat allied to the *M. Sivalensis* and *M. longirostris*. There is no indication of tusks in the symphysis, and the superior tusks have a broad band of enamel. In size, it was about that of the African elephant.

X. GEOLOGY.

The mastodon lived during three distinct periods of the world's history, viz., Miocene, Pliocene, and Alluvial. As the Glacial period is placed between the Pliocene and Alluvial, a fourth age must be added. It experienced great changes in the climate, as well as having lived during the

development and final extinction of various animals. It saw the gradual change going on in the surface of the earth, and the tropical plants gradually circumscribed to their present narrow limits. It lived for untold ages, and at last became extinct itself. In Europe it ceased to exist long before the historical period, probably three or four hundred thousand years, but in America it survived until a comparatively recent period.

XI. FIRST APPEARANCE.

When the mastodon first roamed through the forests the world was far different from what it is now. It was at a time when old forms had become extinct, and a new order of existences had taken their place. It was pre-eminently the Age of Mammals, when creatures of this order not only flourished everywhere, but increased in size to their greatest development. The internal heat had to a great extent ceased to make itself felt on the surface on account of the earth's crust increasing in thickness, in consequence of which changes in the climate gradually took place. The temperature, at the beginning of this period (Miocene), all over the world, was not unlike that of the tropics at the present time; but this change in the climate, after a series of ages, resulted in cold making itself felt not only at the poles, but also in regions near the temperate zones.

In this age of sylvan beauty, the mastodon dates its birth. It was the middle period of the Age of Mammals, or the Tertiary. If a panorama could be presented before us, representing this epoch, the grandeur, beauty, and curious forms would for the moment bewilder the eye, and were it possible for us to be transported to those scenes, we would realize a world outrivalling all human conception. Language cannot picture it, nor mind conceive its beauty. From the relics left of that age, we can, in a measure know something of the scenes and the epoch which gave the

mastodon birth. The mind can picture to itself a scene which may have taken place. It can behold a man sitting on yonder rock, against the mountain's side, viewing the landscape beneath him, and contemplating the scenery which greets his eyes. Nearly everything is new; it is a new world; in many respects, outwardly, it is our earthly dream of paradise; new plants, new flowers, curious trees, strange birds and beasts, as well as those whose forms are familiar, are here. To the left stretches out a beautiful lake which receives the contents of the meandering streams as they flow from the mountain's side, the forest, or the rolling meadow beyond. Upon the banks of the lake and larger streams, the slimy serpents lie basking in the sun, while the heavy crocodiles drag their unwieldy bodies along the miry shore, and the huge hippopotami and rhinoceros push their way through the high marshy grass. In front is a beautiful forest with trees rivalling those of other ages, some are radiant with flowers, others bending to the ground with their ripened fruit, while here and there stands a monarch towering high above all. Low murmuring noises proceed from this enchanting scene which tell that animated forms are concealed within and beneath the superabundant foliage. Within the foliage may be heard the sweet notes of the feathered songster, and here and there they may be seen dressed in the richest and most variegated plumage. Suddenly the spectator's attention is drawn to a spot not far removed from the base of the mountain. Crashing through the forest comes the mightiest of all beasts, the Dinotherium, the colossus of the ancient world, with its elephantine trunk raised aloft, its jaws wide open, and with stupendous strides, making every endeavor to secure protection beneath the water of the neighboring river. It is hotly pursued by the Machairodus (an animal larger than the tiger), which shortly overtakes it and with its sword-like teeth cuts the flesh away, and soon the mighty

monster of both land and sea falls a victim to the fierce, carnivorous creature. On the right, emerging from the cloud of dust, shuffling along, comes another beast, with long white curved, massive tusks, twelve feet in length, and from the under jaw proceeds another a foot in length. It looks like an elephant, and yet it is not; at full speed it moves along, and holding in its long black trunk a ponderous limb with its branches, it furiously beats its sides to brush away the great insects, as large as barn-swallows, which sting and goad it into fury; still hastening on, it plunges into a stream where it is released from its tormentors. This animal is the mastodon, and in the distance may be seen not less than ten species of them.

From the contemplation of this varied scenery, and the thoughts awakened by the struggles incident to the animal world, our spectator, still in his altitude of observation, is startled by deep rolling thunder in the distance which gives notice of an approaching storm. Looking over the landscape again he sees untold numbers of animals hastening from the woods and over the plains to the mountains beyond; a troup of mastodons come crashing through the woods, driven by fear and leaving destruction in their trail; a herd of wild horses are galloping over the meadows; the Sivatherium (a deer having the bulk of an elephant) breaks from the forest and is soon lost to view; the strange and frightened actions of the dogs, lions, antelopes, oxen, etc., forbode the gathering of a terrific storm. No sooner has the last animal disappeared, than the deep, thick, impenetrable masses of clouds gather around. Tremblingly our spectator leaves the rock to seek protection in a neighboring cave; at the cavern's entrance he pauses to look around, when there flashed a stream of light so vivid, so intensely bright, sundering the very heavens, as it were, and immediately followed by a peal of thunder that shook the very fastnesses of the mountain, and then the storm

burst forth in all its fury. One moment the country around was as black as ink, the next it was a sheet of living flame. Safely sheltered within the cavern the man, we have been watching, hears heaven's artillery belching forth one long continued roar of thunder deafening his ears, and seemingly unsettling the very foundations of the earth, while the lightning's lurid glare penetrates the hidden recesses of the cave. Huge masses of rock, detached from their fastnesses by the lightning and the flood, roll down like an avalanche into the forest cutting great thoroughfares as they move violently along. The storm, at last, having abated, there may now be seen great furrows filled with water; the rivers' banks flooded; trees of the forest broken, some upturned, and others carried a long distance. Our spectator leaves his retreat, refuses to descend into the valley, and passing over the mountain, the world discloses another age almost rivalling the one just closed.

In an age such as this the mastodon began to exist; it flourished, and greatly multiplied in both number and species; but, finally, like many others which preceded it, it too was forced to turn aside, lie down, and die, leaving its mementos for man to read in later ages.

XII. DISAPPEARANCE.

The cause or causes which led to the final extinction of the mastodon must be left to conjecture. It would seem that an animal of such gigantic size, great strength, and such a wide distribution, would not easily succumb, but that representatives would still survive. Climatic changes alone have not worked its destruction. This might be inferred for the northern localities, but the theory would not apply to the Southern States, Mexico, and Central America. Certain species of animals have become extinct, but the cause or causes remains unknown. The disappearance of certain wild animals in certain localities can be accounted for—

many having succumbed through the extirpating power of man, such as the bear, wolf, and other creatures in the British Isles, and in this country. From the same cause the buffalo, bear, and many others are gradually, and in some cases rapidly, diminishing. This will not account for the extinction of the mastodon, even admitting that man was coeval, and assisted in its extermination. Vegetation appears to be the same as when the latest of these creatures lived; neither can it be safely concluded that the climate may have undergone any remarkable alteration at the period of its final extinction; nor can it be attributed to either a general or local inundation. It is true a species may be overwhelmed by some calamity, such as a change in climate, or an inundation, or scarcity of a particular kind of food, or the sudden irruption of another genus. There is no fixed law which determines the duration of any species, for both single and whole groups of any genus last for very unequal periods. An animal does not exist because of its bodily strength alone, for mere bodily strength does not give the victory in the battle of life. It is a fact, which any one may notice, that the increase of any group is constantly being checked by certain known or else unperceived hostile agencies, and that the unknown agencies are sufficient to cause rarity, and even final extinction. The continued increase of the existing elephant in India and Africa, before man became a power there, must have been checked by some cause. Dr. Falconer was of opinion that their increase was checked chiefly by blood-sucking insects which incessantly harrassed and weakened them. It may then be inferred that the extinction of the mastodon was due to some imperceptible hostile agency which first made it rare and then finally exterminated it.

PART SECOND.

THE MAMMOTH.

PART II.

THE MAMMOTH.

I. NAME.

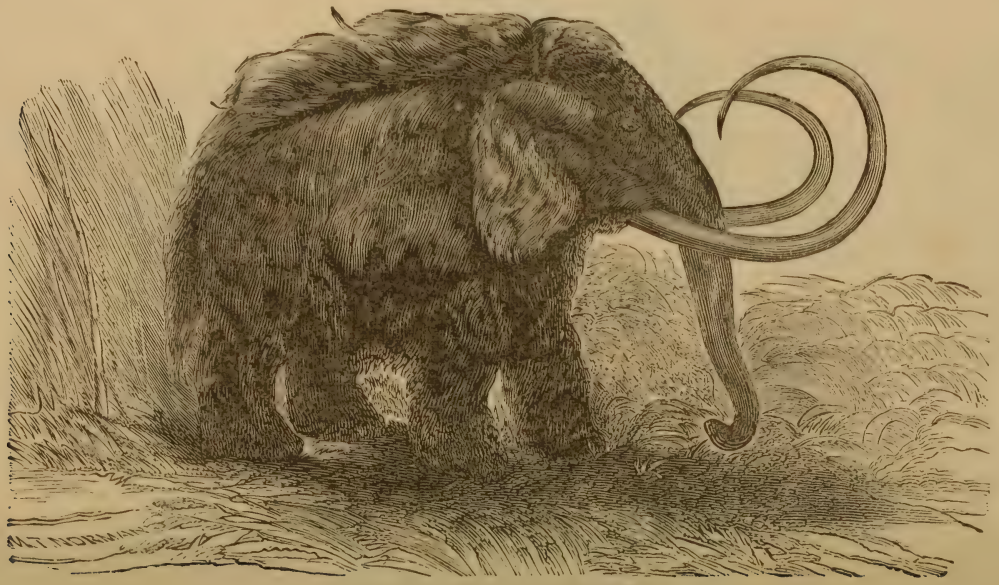
The mammoth, sometimes called the Hairy Mammoth, and sometimes the Siberian Elephant, according to Pallas, a celebrated Russian savant who first gave a description of it, owes its name to the Tartar word, *mamma*, meaning *the earth*. It was so named because the Tungooses and Yakoots believed that this animal worked its way in the earth like a mole. They declare that the mammoths have withdrawn into great subterranean caverns, from whence they never emerge, but wander to and fro in the galleries, and as they pass into one the roof of the gallery rises, while the roof of the one just vacated sinks. The moment this animal sees the light it dies, and the reason so many have been exposed to view is because of their having been deceived by the irregular conformation of the land, thus unintentionally venturing beyond the confines of darkness. Among scientists it is known as the *Elephas Primigenius* (primitive elephant), this name having been bestowed on it by Blumenbach. The scientific name is a misnomer, for several different groups of the elephantine family flourished and became extinct long before this variety was produced. The mastodon and the elephant lived through two

long periods of the earth's history before the mammoth became their contemporary. It is better known under its common name, and by that it will continue to be called. Three distinct species have been made out, viz: the *E. primigenius* of Europe and Siberia, the *E. Americanus* and *E. Imperator* (Leidy) of America. Dr. Leidy thinks that the *E. Imperator* is probably the same as *E. Columbi* of Dr. Falconer.

II. DESCRIPTION.

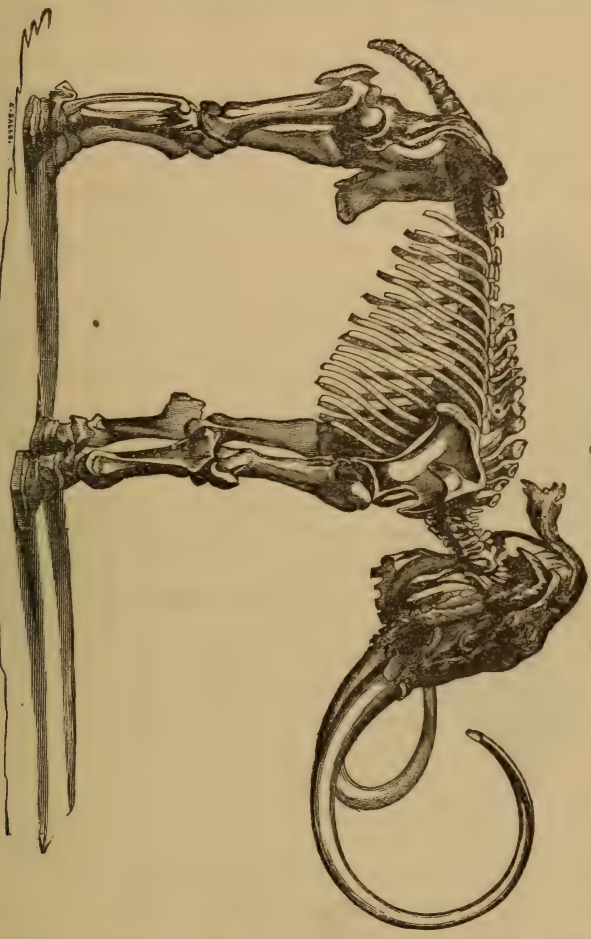
The mammoth surpassed the largest of existing elephants in size, for it was from fifteen to eighteen feet in height, and somewhat exceeded them in length. Unlike the elephant, which it very much resembled, it was thickly covered with long shaggy hair, and a copious mane floated upon its neck and along its back. This covering was composed of three distinct suits of hair and wool, the longest rough, black, bristle-like hairs about eighteen inches in length, serving for the ruder purpose of defense; the next was a shorter coat of close set, tolerably fine hair, fawn-colored, from nine to ten inches long; within this lay a coating of wool, of a soft reddish texture, about five inches long, fitting the intervals between the other hairs, thus affording an inconsiderable protection against the weather, and enabling the animal to withstand the greatest rigor of climate in which it lived. Its body was heavier and legs comparatively shorter than that of the elephant. The tusks were enormous, being along the curve from eleven to fifteen feet in length, which, instead of projecting downwards and forwards, curved quite abruptly outwards and backwards, as seen in the engravings, Figures 5 and 6, while the alveoli was very long. The skull was elongated, the forehead concave, and the lower jaw obtuse. The grinding tooth forms one of its most conspicuous characteristics, and very singularly the whole of the tooth is not brought into use at once, but formed by degrees as it is required. In the

Figure 5.



THE MAMMOTH RESTORED.

adult animal only four teeth exist, one on each side of each jaw. The tooth is massive, sometimes weighing not less



SKELETON OF THE MAMMOTH.

Figure 6.

than seventeen pounds, being broad, the crown divided into a number of successive plates, and these plates into subcylindrical processes, thus presenting the conditions

most favorable to progressive formation. This subdivision of the grinder gives it an important advantage, for each part is formed like a perfect tooth, having a body of dentine, a coat of enamel, and an outer investment of cement, and each process almost complete within itself. The more advanced and more abraded part of the crown is traversed by the transverse ridges of the enamel investing the plates, inclosing the depressed surface of the dentine, and separated by the deeper channels of the cement. The forepart of the tooth gives way first, for the continued grinding on that part reduces the enamel and cement which invest the dental plates. This wearing away of the forepart of the tooth does not entirely unfit it for service, but was used for the first coarse crushing of the branches of a tree, and the succeeding part of the tooth serves to still further grind the food and reduce it to a pulp. Figure 7 represents the last molar but one. This specimen was found in France by Lartet.

Fig. 7.

Penultimate Molar of the Lower Jaw.

The tooth found near Zanesville, Ohio, many years ago, is one of the best which has been described. Its weight was over seventeen pounds, and its length eighteen inches. It was one of the set of permanent molars, of a light color, and quadrangular in form. Of the four faces the inferior is oval in form, broad in the middle and narrow at each extremity. The plates in the surface are sixteen in number, formed of two layers of enamel, displaying the remains of former plates, now reduced to common dentine. The posterior and inferior faces show the termination of undeveloped plates. The superior border contains the roots, and the fourth face, or

anterior ridge, is very short and irregular, being that portion of the tooth which has been reduced by constant usage.

The teeth resemble those of the Asiatic elephant, but are broader, longer, and heavier; the same in number and development, and constructed on the same anatomical plan; but, notwithstanding these resemblances, they differ in some particulars. The teeth of the elephant contain twenty plates, while that of the mammoth thirty. Hence by the structure of their teeth they were able to employ as food the branches and foliage of the northern pines, birches, willows, etc.

III. RANGE.

The mammoth ranged over a large part of the earth's surface, its remains having been found in North America from Behring's Straits to the Gulf of Mexico, and in the Old World from the eastern extremity of Siberia to the extreme west of Europe, and as far south as Rome and the Pyrenees. So abundant are these relics that there is scarcely a cabinet that does not contain them. Over two thousand molar-teeth were dredged up on the coast of Norfolk alone, between 1820 and 1833, by the fishermen of the little village of Happisburg, while trawling for oysters. The islands in the sea north of Siberia are composed of sand, ice, and the remains of the mammoth. Year after year the waves disintegrate these masses and cast on the shore large quantities of fossil tusks, and the rivers in the north of Siberia, in the season when the thaw takes place, sweep down portions of their banks and disengage the bones buried in the soil. In the cliffs of frozen mud in Escholtz Bay, Alaska, they occur in great numbers, and at Big Bone Lick, in Kentucky, remains have been found belonging to about twenty-five different individuals. The ivory washed out in the rivers of the north is in a remarkable state of preservation. Every summer the fishermen of Siberia visit the islands of the Frozen Ocean and search

along the banks for the fossil ivory, and in the winter are followed by numerous caravans, all the convoys drawn by dogs, and return with tusks of the mammoth, each weighing from one hundred and fifty to two hundred pounds. This fossil ivory is sent to China and Europe, where it is employed for the same purposes as the ivory of the living elephant, and is often equally as good. In 1844 sixteen thousand pounds were sold in St. Petersburg alone. Although this ivory has been exported to China for the last five hundred years, and to Europe over one hundred years, yet the supply appears to be undiminished. According to Tilesius, there are enough bones still left in Northern Russia to greatly exceed in number those of all the elephants now living on the globe.

IV. HISTORY.

In nearly all ages and countries chance discoveries have been made of fossil bones of the elephant. That all these are to be ascribed to the mammoth is improbable, but many of them doubtless belonged to that animal. Fossil ivory was discovered in the soil of Greece as early as 320 B. C. The fossil bones of the elephant family when first discovered were ascribed either to human beings or else the demi-gods. The patella of a fossil elephant found in Greece was taken for the knee-bone of Ajax; the remains, thirteen feet in length, discovered by the Spartans at Tegea, were assigned to the body of Orestes; those, eighteen feet in length, discovered in the Isle of Ladea, were assigned to Asterius, son of Ajax; the bones discovered in the fourth century at Trapani, in Sicily, were ascribed to the pretended body of Polyphemus. So numerous were the discoveries, and so universally regarded to be those of human beings, that the literature of the middle ages, on this subject, is quite voluminous, and has been entitled "Gigantology."

In 1456, in France, bones of pretended giants were noticed in the bed of the Rhone. Soon after other discoveries were made near Saint-Peirat, opposite Valence, which were cared for by the Dauphin, afterwards Louis XI, and sent to Bourges, where they long remained objects of curiosity in the interior of the Saint-Chapelle. In the same neighborhood, in 1564, two peasants noticed, on the banks of the Rhone, some great bones sticking out of the ground. Cassanion pronounced them giants' bones, and this discovery doubtless caused him to write his treatise entitled "De Gigantibus."

In the Canton of Lucerne, Switzerland, in the year 1577, a storm uprooted an oak near the cloisters of Reyden, exposing some large bones. These bones were examined by Felix Platen, then a celebrated physician and professor at Basle, who declared them to be the remains of a giant nineteen feet in height. On account of the conclusions of Platen the inhabitants of Lucerne adopted the image of the fabulous giant as the supporter of the city arms. In 1706 only two fragments of the skeleton remained, which, on being examined, by Blumenbach, were recognized as belonging to the elephant.

Otto de Guericke, a celebrated physicist and inventor of the air pump, in 1663, witnessed the discovery of the bones of the elephant, along with its enormous tusks, buried in the shelly-limestone, Germany. The tusks were taken for horns, and out of the remains Leibnitz constructed a strange animal, carrying a horn in the middle of its forehead, and in each jaw a dozen molar-teeth a foot long, and calling the creature the *fossil unicorn.* In his "Protogæa" he gave a description and a drawing of the imaginary animal. For more than thirty years the unicorn of Leibnitz was universally accepted throughout Germany, and was only dissipated by the discovery of an entire skeleton of the mammoth in the valley of the Unstrut.

Isbrant Ides, an intrepid Russian traveler, explored the principal regions of Northern Asia, and in 1692 reported that "amongst the hills, which are situated north-east of the river Kata, the mammuts' tongues and legs are found, as they are also particularly on the shores of the river Jenize, Trugan, Mongamsea, Lena, and near Jakutskoi, even as far as the Frozen Ocean. In the spring, when the ice of this river breaks, it is driven in such vast quantities and with such force by the high swollen waters, that it frequently carries very high banks before it, and breaks off the tops of hills, which, falling down, discover these animals whole, or their teeth only, almost frozen to the earth, which thaw by degrees. I had a person with me who had annually gone out in search of these bones; he told it to me as a real truth, that he and his companions found the head of one of these animals, which was discovered by the fall of such a frozen piece of earth. As soon as he opened it, he found the greatest part of the flesh rotten, but it was not without difficulty that they broke out his teeth, which were placed in the fore-part of his mouth, as those of the elephants are; they also took some bones out of his head, and afterwards came to the fore-foot, which they cut off, and carried part of it to the city of Trugan, the circumference of it being as large as that of the waist of an ordinary man. The bones of the head appeared somewhat red, as though they were tinctured with blood."

This traveler further informs us that the old Siberian Russians affirmed "that there were elephants in this country before the Deluge, when this climate was warmer, and that their drowned bodies, floating on the surface of the water of that flood, were at last washed and forced into subterranean cavities; but that after this universal deluge, the air, which before was warm, was changed to cold, and that these bones have lain frozen in the earth ever since,

and so are preserved from putrefaction till they thaw, and come to light, which is no very unreasonable conjecture, though it is not absolutely necessary that this climate should have been warmer before the Flood, since the carcases of the drowned elephants were very likely to float from other places several hundred miles distant to this country in the great deluge which covered the surface of the whole earth."

A veritable cemetery of elephants' bones was discovered, in 1700, by a soldier of Wurtemberg, in which were not less than sixty tusks in the argillaceous soil near the city of Canstadt. The bones which were entire were preserved, but the fragments were given to the court physician, by whom they were used to combat fever and colic.

About the year 1772, Pallas traveled through Siberia and described the bones of the mammoth as occurring in a very fresh state throughout all the Lowland of Siberia. He found their bones imbedded with marine remains and fossil wood or lignite, such as, he says, might have been derived from carbonized peat.

The Church at Valence, Spain, possessed the molar tooth of an elephant which was ascribed to St. Christopher, who, by the way, only existed in legendary tales; and in 1789 an elephant's femur was carried through the streets in public procession to procure rain, by the canons of St. Vincent, who pretended it was the arm of a Saint.

During the eighteenth century the discoveries were very numerous, and the erudition of that time easily unraveled the mystery. But as science has been forced to contest its way step by step, so even then a check to her progress was attemped. Some wiseacre declared that the bones found in France and Italy, were the remains of the elephants which Hannibal had brought from Carthage in his expedition against Rome. Many thought this view was very plausible, from the fact that these bones were numer-

ously found along the route of the Carthagenian army. But as these bones are found where no Carthagenian ever trod, or any army with elephants in its train, the fact no longer becomes plausible. Even if the remains of elephants were only found along the route of Hannibal, their position in the earth, as well as their distinct variety, would preclude the idea that they came from Africa with the Carthagenians.

In 1799, Ossip Schumachoff, a Tungusian chief, while seeking for mammoth tusks at the mouth of the river Lena, found a shapeless mass frozen in the ice. The following year he noticed that this mass was more disengaged from the blocks of ice, and had two projecting parts, but was still unable to make out what it could be. It was not until the summer of 1801 that the hunter knew upon what he had stumbled. The animal still remained buried, but a portion of it was sufficiently exposed to disclose what it really was. Returning to his home Schumachoff told his family what he had seen, which caused great consternation and even sickness, for they believed that the discovery of the mammoth entire must result in death to the whole household. Death, however, did not ensue. Recovering from his almost fatal sickness into which his superstitious fear had thrown him, he revisited the spot in March, 1804. In the meantime, however (1803), the ice between the mammoth and earth having melted faster than the rest the enormous mass fell on a bank of sand. The hunter cut off the tusks and sold them to a merchant for thirty-six dollars and fifty cents. The people of that neighborhood cut off the flesh, with which they fed their dogs; wild beasts, such as white bears, wolves, wolverines, and foxes fed upon it, until the skeleton was almost entirely cleared of its flesh. "According to the assertion of the Tungusian discoverer, the animal was so fat that its belly hung down below the joints of the knees. This mammoth

was a male, with a long mane on the neck; the tail was much mutilated, only eight out of the twenty-eight caudal vertebræ remaining; the proboscis was gone, but the places of the insertion of the muscles were visible on the skull. The skin, of which about three-fourths were saved, was of a dark gray color, covered with a reddish wool, and coarse long black hairs. The dampness of the spot where the animal had lain so long had in some degree destroyed the hair. The entire skeleton, from the fore-part of the skull to the end of the mutilated tail, measured sixteen feet four inches; its height was nine feet four inches. The tusks measured along the curve nine feet six inches, and in a straight line from the base to the point three feet seven inches." * In 1806, Mr. Adams, of the St. Petersburg Academy, learning of it, repaired to the place. He collected the bones, and detached the skin on the side on which the animal had lain, which was well preserved, and so heavy that ten men found great difficulty in transporting it to the shore. He dug up and collected thirty-six pounds of the hair which the white bears had trodden into the ground. He succeeded in re-purchasing the tusks at Jatusk, and forwarded the whole to St. Petersburg, a distance of seven thousand three hundred and thirty miles, where he sold it to the Emperor of Russia for six thousand dollars. It is now deposited in the Museum of the Academy of St. Petersburg. A view of this skeleton is given in Fig. 6. It will be noticed that the dried skin still adheres to the head and feet.

In 1800, Gabriel Sarytschew, a Russian naturalist, while traveling near the Frozen Ocean, found upon one of the banks of the Alascia the entire body of a mammoth in a complete state of preservation, enveloped in a mass of ice.

In 1843, Middendorf, a distinguished Russian naturalist, discovered a mammoth on the Tas, between the Obi and

* Owens' "British Fossils."

Yenesei, near the Arctic Circle, latitude 66° 30′ North, with some parts of the flesh in a perfect state of preservation. The ball of the eye is in the Museum at Moscow. In the same year, two other carcasses, one of them that of a young individual, were met with in latitude 75° 15′ N., near the river Taimyr, with the flesh decayed. They were imbedded in strata of clay and sand, with erratic blocks, at about fifteen feet above the level of the sea.

In 1860 a great number of bones of the mammoth were found in Belgium, in the province of Antwerp, while digging a canal at Lierre. M. Dupont constructed from these bones an entire skeleton of a young mammoth, eleven feet six inches high (to the shoulder), which was placed in the Royal Museum of Natural History in Brussels.

In 1866 many skeletons were found retaining the skin and hair, in the flat country near the mouth of the Yenesei, between lat. 70° and 75° N. The heads of most of them were turned towards the south.

The Academy of St. Petersburg, in 1869–70, sent out an exploring expedition under Herr Von Maydell, to the river Indigiska, to examine some remains said to have been discovered there. The exploring party found the skin and hair as well as the bones of the mammoth at two points on the river, about thirty miles distant from each other, and sixty-six miles from the Arctic Sea.

V. CLIMATE.

Judging solely by our knowledge of the elephant it would appear that the climate of Siberia was tropical when the mammoth fed upon the banks of the Lena and other tributaries of the Arctic Ocean. The present habitat of the elephant is tropical, and it is classed as a tropical animal. The geologists, from their studies of the tertiary formations, expected to find only tropical fauna and flora in the epoch immediately succeeding. To conclude

that because an animal flourishes under a high temperature, consequently all remains of that family or class must be assigned to the same climate, is fallacious. The tiger is classed as a tropical animal, and yet it is sometimes seen at the very edge of perpetual snow in the Himalaya, among the snows of Mt. Ararat, and is common in the neighborhood of Lake Aral, near Sussac, in lat. 45° N., and are also found in lat. 48° and 53° N. In the summer of 1828 a tiger was killed on the Lena, in lat. 52¼° N., a climate colder than that of St. Petersburg. The zebra roams over the tropical plains, while the horse successfully withstands a rigorous winter; the buffalo prefers a mild temperature, but the musk-ox the stinted herbage of the arctic regions, while the common ox prospers almost everywhere. The African and polar hares have their geographical distribution expressed in their respective names, and, as is well known, bears are found in various regions and climates.

As early as 1829 Dr. Fleming called in question the supposition that the bones of the mammoth, and others associated, implied a tropical climate. Other writers soon followed upon the same line of argument, and at the present time it is universally admitted that it withstood the rigors of the Siberian climate. This conclusion is not difficult of belief, for, in many respects, the mammoth was decidedly different from the two living species of elephant; and if the tiger in our own times can range to the borders of Siberia, or skirt the perpetual snow of the Himalaya, why may not this colossal pachyderm, with its triple clothing, have approached still nearer the Frozen Ocean? To this should be added the fact that the animal has been found entire in the ice, thus proving beyond all question that it endured a cold climate. It must be observed that the mammoth did not inhabit the northernmost flat tracts of Siberia, in which the remains are so abundant, for at

the period when they existed the wide and low districts of that sterile region were beneath the sea; hence the bones and carcasses must have drifted thither, and probably from a considerable distance.

The climate of Europe was not so rigorous as that of Siberia when the mammoth flourished as far south as the Pyrenees. During a portion of this time the climate was undoubtedly cold, and again it was warm and pleasant. As regards the climate of the United States at that time, we have no reasons for believing that it was any different from that of the present. It made its appearance in the Pacific States during the latter part of the Pliocene, and no evidence of a great glacial epoch is there. It is probable then that the mammoth did not always have the same heavy coating of hair.

VI. FOOD.

The elephant of India lives in noble forests and impenetrable jungles. It would be natural to suppose that all of the different varieties of the elephant family not only required vast quantities of food, but must also live off of the same kind, and dwell where there is a superabundance. An extinct species should not always be judged solely by a living one. The teeth of the mammoth clearly indicate a difference in food, for it had a larger proportion of dense enamel which enabled it to feed on the coarser ligneous tissues of trees and shrubs. Even though its food was different from that of the living species there would be nothing singular or remarkable about it, for the food of the fallow-deer, stag, or roe, is of a granivorous character, while the reindeer, on the other hand, lives upon the lichen. Their food then was of a coarse nature, probably the branches of the fir, birch, poplar, willow, etc. Travelers tell us that even now on the banks of the Lena, as far north as lat. 69° 5′, there are woods of fir, birch, poplar, and alder.

It has been suggested that the mammoth, with its contemporary, wooly-haired rhinoceros (*R. tichorrhinus*), was migratory in its habits, wandering towards the north in summer, and southward during the winter. This is true of the musk-ox. It annually deserts its winter quarters in the south, and crossing the sea upon the ice, grazes for four months, from May to September, on the rich pasturage of Mellville Island.

Taking the view that the climate of Siberia was at that time very cold, the question must arise how could these animals have been supplied with enough food, for it is evident that the cold would interfere with the growth of trees, and as the remains of the animals surpass all calculation, an abundance of food would be required? It is a remarkable fact that the southern part of Africa, from the tropic of Capricorn to the Cape of Good Hope, although sterile and desert, yet is noted for the number and bulk of its quadrupeds, viz: the elephant, five species of rhinoceros, the hippopotamus, the giraffe, the ox (*Bos Caffer*), the eland, the quagga, two species of gnu, two species of zebra, besides several of antelopes. In one day's march, through this country, in lat. 24° S., through a tract thinly covered with grass, bushes, and trees, there were seen one hundred and fifty rhinoceroses, several herds of giraffes, and many hippopotami. This phenomenon is explained by supposing that the underwood, of which the food of some chiefly consists, contains much nutriment in a small bulk, and also from the fact that no sooner is a part consumed than its place is supplied by a fresh stock. Then, again, the quantity of food required by the larger herbivora is much less than is generally imagined. But making every allowance for all this, and many other considerations, yet it would be impossible for the vast numbers of mammoths, and other animals, to subsist throughout the year in southern Siberia, covered as it is with snow in winter.

A solution then may be offered by supposing that a vegetation once flourished between the latitudes 40° and 65° N. capable of nourishing this great quadruped.

In regard to Europe and America during the mammoth epoch we meet with no difficulty, for such food as it required was abundant.

VII. EPOCH.

The epoch of the mammoth has been assigned to the post-tertiary, but there are certain evidences, already alluded to, which point to the latter part of the Pliocene as the time of the birth of the mammoth. It lived throughout the long glacial period, and, in Europe, survived it for many ages. Its bones, in various localities, have been found in company with those of the mastodon. In Europe the period of these two species is different, the mastodon having long preceded the mammoth; while in America it was the contemporary of the *M. giganteus*. There is one instance of mastodon molars occurring with mammoth teeth in Europe, in the quaternary formation of Imola. This would seem to indicate that some stragglers continued to live in Europe until the time of the mammoth. The mammoth, in Europe, became extinct about the beginning of the Reindeer epoch. It had ceased to flourish before that time. It is not improbable that it became extinct in the United States about the same time. In the latter country no complete skeleton has yet been found. It should be remarked that it has been claimed that the mammoth of Europe is found only in the drift stratum, while that of the United States is imbedded above the drift. From this it has been concluded that the mammoth of America is distinctly of a more recent age. But as the true diluvial of Europe precedes the Reindeer epoch, by a long period, it would show that the mammoth survived the period intervening between the diluvial and the Reindeer

epoch. That the mammoth did survive is evident from the sketches of it which have been recovered.

In reference to the time when the mammoth first entered Europe we can speak with more certainty than when it began to exist in Siberia. Some would date its existence in Siberia prior to the glacial epoch, and those which have been found entombed in the ice have remained there ever since its close, while others would refer it to the time corresponding with the Mammoth or Inter-Glacial Epoch of Europe, and still others would have us deny all the incontestable facts and date its existence to very recent times. There is an important point which should be observed: Under the gravel, mud, and ice that contain the remains of the mammoth, there has been found a layer of pure ice, the thickness of which is unknown. So far as is now known the climate of Siberia was cold long before the mammoth sought a retreat there, and the probability is that this climate ante-dates the glacial age. Having lived on the Western Hemisphere before the glacial age, it is very probable that it lived on the Eastern also before that time, which would date its beginning back several hundred thousand years. Some of the remains found in the Middle States give evidence of a very high antiquity, and others appear to be very recent. M. Lartet was of opinion that these animals lived in Siberia long before they found their way into Europe.

VIII. DESTRUCTION.

Many theories have been propounded in accounting for the final destruction of the mammoth. There is one solution which seems to be plausible and does away with the speculations concerning a sudden revolution for their extirpation. A map of Siberia will show that all the great rivers flow from south to north, from temperate to arctic regions. Some of these rivers are among the largest in

the world, the Yenesei having a course of two thousand five hundred miles, and the Lena of two thousand miles. These rivers are filled with running water in their upper course, when frozen over at their mouths for several hundred miles, where they remain blocked with ice during one-half the year. This causes great floods; for the water finding no open channel rushes over the ice and sweeps along forests and great quantities of soil and gravel mixed with ice.

The missionary Huc, in his "Travels in Thibet," in 1846, relates that after many of his party had been frozen to death, the survivors pitched their tent on the banks of the Mouroui-Ousson, and from their encampment saw some black, shapeless objects ranged in file across the stream. On drawing near these objects were discovered to be a troop of about fifty wild oxen, called Yak by the Thibetans, encrusted in ice. They probably had tried to swim across the stream at the moment of congelation, and were unable to disengage themselves. Their heads, surmounted by huge horns, were still above the surface, and their bodies could be seen in the ice as though they were still in the act of swimming. So it may be inferred that mammoths, in returning from their pastures, were caught while crossing the streams by the sudden congealing of the water. Others, of course, died by various means, natural or otherwise, in the northern regions, perhaps not infrequently by the water breaking through great barriers, and in devastating the country, carrying the luckless mammoth into the Frozen Ocean. This view will not account for the entire destruction of the animal. It may be that a gradual change in the climate, and the consequent diminution of food, had something to do with its final extinction. This will not, however, account for the final disappearance in Europe and America. Whether Siberia was its last retreat, and from Europe and America it gradually with-

drew, is not known, yet it is possible that such may have been the case. If this be true, then its extinction is accounted for, but if not, then what was said relative to the disappearance of the mastodon may also be applied to the mammoth. In any case it is not to be presumed that a sudden and awful calamity overwhelmed it. Sir Charles Lyell has very justly remarked that "between the period when the mammoth was most abundant, and that when it died out, there must have elapsed a long interval of ages when it was growing more and more scarce; and we may expect to find occasional stragglers buried in deposits long subsequent in date to others, until at last we may succeed in tracing a passage from the post-Pliocene to the recent fauna, by geological monuments, which fill up the gap." *

IX. PRESERVATION OF REMAINS.

The preservation of the bones throughout Europe and America is due to the same cause or causes as the preservation of the bones of the mastodon; but in Siberia the preservation of the bones, and even of the entire carcass, is due to cold. So long as the body is encased in ice it is impossible for it to decay. It will be preserved intact. There can be no doubt but that these bodies preserved in ice have remained enveloped ever since the day they perished, for had the matrix been disturbed it would have allowed the free percolation of water, which would have decomposed the soft parts of the animal. The climate is most favorable for preservation. Near the mouths of the Lena, at all seasons, at a depth of a few feet, frozen soil may be found, and, according to Professor Von Baer, the ground is now frozen permanently to a depth of four hundred feet at the town of Yakutsk, on the banks of the Lena, six hundred miles distant from the Polar Sea. Throughout a wide area the boundary cliffs of the lakes and rivers con-

* "Antiquity of Man," p. 353.

sist of alternate layers of ice and earthy material, in horizontal stratification. At a depth of seventy feet, after having passed through much frozen soil mixed with earth, Middendorf came upon a solid mass of pure transparent ice. In such a region as this a carcass imbedded in ice and frozen mud may be preserved for indefinite ages. When it is disengaged then it is exposed to the ravages of wild beasts, the rays of the sun, and finally may be transported a vast distance by the water and thrown into the Arctic Sea, or else become buried in fluviatile and submarine deposits near the mouths of rivers. An animal might die and fall into a stream, or be drowned, and then transported northward, and at last be frozen into the thick ice.

PART THIRD.

MAN.

PART III.

MAN.

I. INTRODUCTION.

It has been established beyond all question that man was contemporary with the mammoth and the mastodon. The first discoveries proving this fact were either wholly discredited or attempts made to explain away the facts. At the present time it is universally admitted. That man came into existence at the same time with the mastodon is disputed by some and admitted by others. Every important fact revealed by science has met with stubborn resistance. Its history was well illustrated by Professor Agassiz: "Whenever a new and startling fact is brought to light in science, people first say, 'it is not true,' then that 'it is contrary to religion,' and, lastly, 'that every body knew it before.'" There are a particular few who have constituted themselves the peculiar custodians of the Bible. Their views alone are correct, and in order to harmonize the Bible and science, the former is made to speak the language of the latter, while science, in its turn, is misrepresented and distorted in order to meet the supposed requirements of the former. The discoveries which give to man a great antiquity are wrested from their true place, and are not given the same credit or due weight as is allowed the fossil

bone of an animal. If a competent geologist should assert that he had recently discovered the bones of the mammoth or Siberian rhinoceros in undoubted pliocene formation, it would be readily assented to. But let the same geologist declare that mingled with these bones were human remains, at once he would be either attacked by learned pedants, or else they would amuse themselves by explaining away the force of the discovery.

It is not the purpose here to enter into a discussion of the antiquity of man, but only to give a few illustrations, with observations, which prove that man was coeval with these two colossal proboscidians. Thousands of discoveries have been made establishing this fact, and to enumerate them would be unnecessary. A few of the evidences will meet all that is required. When the remains of man are sought for in formations older than the quaternary their scarcity is at once apparent. This is also true of some of the extinct animals. In some cases not bones enough have been found to make a complete skeleton. In regard to man it should be observed that in those primitive times there were but comparatively few people. Even though certain districts were well populated we should not expect that their bones would be plenty, for, when we turn to modern times, we find a repetition of the same phenomenon. Of the millions of the human race that die every year, although the bodies are carefully laid away, yet, after two or three generations have come and gone, scarcely a vestige remains. When the Lake of Haarlem was converted into dry land, and through this made land thousands of miles of ditches and trenches had been dug, and, although naval engagements had taken place there and forty thousand men or more had been buried in its land, or drowned in its waters, yet no human bones were found, and only a few remains of human art. The flint tools of primitive man were not numerous, and undoubtedly as

much service was obtained from them as was possible. Nor is it to be supposed that all the discoveries have been made that will be, for every hiding place has not yet been uncovered. Then again these relics not infrequently fall into the hands of the ignorant and unappreciative, and hence their value is lost to science.

II. MIOCENE EPOCH.

If in the end geologists should fail to prove that man existed in the Miocene, still there is enough evidence to show that he was not only coeval with, but outlived such gigantic mammals as the Megatherium, Mammoth, Mastodon, Siberian Rhinoceros (*R. tichorrhinus*), Cave Bear, Cave Lion, Irish Elk, a gigantic ox (*Bos primigenius*), and others. All these animals he assisted in destroying, and some of them passed away before his attacks. But why may not man have lived during the Miocene, and thus have been the contemporary of other gigantic fauna? As previously remarked there is a class who strenuously oppose this idea. It is particularly that class which believes that this world was made especially for the benefit of man. If the Creator made this world especially for man, then there was one period particularly adapted to man's wants. The world never experienced a more beautiful period. That period was the Miocene, and by all manner of logical reasoning it was the time when man should have appeared. Dr. Garrigou has forcibly remarked, "From the moment when mammals of so perfect an organization as the mastodons, lions, hyenas, and stags could live in the Miocene air, and adapt themselves to a climate which their presence indicates to have been healthy, from the moment in which M. Lartet has shown us an ape co-existing and developing along with these mammals, why should not man have lived as their contemporary?" There is then no reason why man should not have existed at this time; the climate was

tropical, and the conditions favorable. As an anthropomorphic ape (*Dryopithecus Fontanii*) then lived, there exists no physiological reason why man should not have lived also. Recent explorations have justified this reasoning.

The following is the enumeration of works of art found in conjunction with the mastodon:

The discovery made by M. Bourgeois of flint flakes and scrapers, in the Miocene strata of Thenay, along with the bones of the mastodon, is rejected by some geologists, as an evidence of Miocene man, because M. Bourgeois did not show that the implements may not have been ultimately derived from the surface of the ground, where they were abundant. M. Hamy, who appears to be competent to speak on the subject, declares that the discovery is genuine, and proves that man was an inhabitant of Miocene Europe.

In 1869, M. Bourgeois found, in a stratum of Miocene near Pontlevoy, numerous worked flints, and other flints which had been subjected to the action of heat. These works of man were beneath five distinct beds, one of which contained the rolled bones of the mastodon, rhinoceros, and dinotherium. This evidence would place man back of the time of these individual animals.

Mr. Frank Calvert, in 1873, discovered, near the Dardanelles, a fragment of a bone belonging either to the mastodon or the dinotherium, on the convex side of which was engraved a horned quadruped, having an arched neck, lozenge-shaped chest, long body, straight fore-legs, and broad feet. There are traces of other figures, which, however, were nearly obliterated. In the same stratum he also found a flint flake, and several bones broken as if for the extraction of the marrow. Mr. Calvert thinks that this stratum undoubtedly belongs to the Miocene. It was necessary to discredit this story, so "Professor George Washburn, of Roberts College, Constantinople," stepped

in and made the following announcement: there is not the slightest trace of workmanship on the specimens; the scratches on the bones represent nothing and do not appear to be artificial; the flints are mere natural fragments; and the bones alleged to be split by man are a delusion. One great difficulty with the Professor's statement is, it is entirely too strong. It savors too much of trying to make out a case. He should prove that those flints are not only natural but common to that region. On the other hand, Sir John Lubbock declares that Mr. Calvert is a competent observer. It is hardly credible that he could have been mistaken in reference to these drawings, for he appears to have been fully acquainted with such works of art. Time may throw more light on this discovery.

III. THE PLIOCENE.

The latest recorded instance of Pliocene man is given by Professor Cope. He recently received from Oregon a collection of fossils belonging to different genera, including the mammoth, from an ancient lake-bed of Pliocene age. Mingled in the same deposit in undistinguishable relation, were found numerous flakes with arrow and spear heads of obsidian, many of them much tarnished by long erosion. All the relics were mingled together and lying on the surface of a bed of clay, from fifteen to twenty feet beneath a deposit of volcanic sand and ashes.

There have been a great number of discoveries of human remains and works of art in the gold-bearing drift of California; and, in not a few instances, in conjunction with the bones of the mastodon. It is so well established that man and the mastodon were contemporary in California that no one would dispute it, save touching the period in geological history. Professor Whitney, the eminent geologist, says that elephant and mastodon bones are found all over the State, at the surface and at a depth of a hundred feet

or more, and it is very common to find them in connection with human implements.

Human skulls, weapons of stone, and stone mortars have been found in the auriferous gravel or gold-drift from two hundred to three hundred feet below the surface, along with the remains of the mammoth and mastodon.

Three evidences are herewith subjoined, as a farther enumeration is not necessary:

Dr. C. F. Winslow sent to the Boston Natural History Society, in 1857, a fragment of a human cranium found in the "pay-drift," one hundred and eighty feet below the surface of Table Mountain, California, in connection with the bones of the mammoth and mastodon. It was in the same region of country where the human skull found by James Matson was taken from a depth of a hundred and fifty feet below the surface, and under five beds of lava and four deposits of auriferous gravel.

In the gold-drift of Kincaid's Flat, a stone mortar and pestle, besides other implements, were found twenty feet below the surface in connection with the bones of the mammoth and mastodon.

At Shaw's Flat, a stone bead of calc-spar and a granite mortar, holding about a pint, were found along with the bones of the mastodon in the gold-drift, about three hundred feet from the mouth of the tunnel.

The age of the gold-drift is referred by Professor Whitney to the Pliocene, and consequently to that time preceding the volcanic eruptions which once occurred over the greater part of the State.

In order to avoid the simple geological fact which places man alongside of the mastodon of the Pliocene, in California, a novel hypothesis has been resorted to. Briefly stated, it is that these remains of man belong to prehistoric miners who had sunken shafts into these places. This is inferred because supposed ancient shafts have been dis-

covered. If these remains had been found in ancient shafts or tunnels then it is evident that they are not to be assigned to the Pliocene. Cases of this kind are not to be inferred, but proven. The fact that ancient shafts may have been discovered does not prove, by any means, that all works of art found below the surface are due to the shafts. Since the point or points where these remains were found gave no evidence of a shaft or tunnel ever having been there, or any other intrusive disturbance, it must be accepted that the bones and implements were deposited at the same time with the drift. If it should be further claimed that the human remains belong to an intrusive age it may be very pertinently asked, Why not the mammoth and mastodon bones also? In regard to the skull from Calaveras county, found by James Matson, the upper bed of tufa was homogeneous and without crack through which a human relic could have been introduced into the lower beds. Hence it is easily seen that the attempt to dispute the facts is simply unwarranted.

It may not be out of place to remark here that there were self-constituted and swift witnesses to disprove the authenticity of the skull from Calaveras county, and who declared that the discovery was simply the perpetration of a joke on Professor Whitney. It is now, however, generally conceded that what Professor Whitney stated is to be accepted.

IV. GLACIAL PERIOD.

The relics from the valley of the Somme (France) thoroughly awakened the attention of the geologists, and on account of the numerous discoveries there made, which convinced the antiquarians of the high antiquity of man, it has become classical ground to the archæo-geologist. Here, too, the remains of man and worked flints are found with the remains of the mammoth.

So much has been written concerning these discoveries, and so well known is the fame of the locality to intelligent readers, that it will only be necessary here to state in outline the formation in which the relics were found. In another work * I have given a full description, with an illustration, of this locality. It shows a section of the gravel-pit at St. Acheul, illustrating the five formations composing it. The first is vegetable and made soil from two to three feet thick. Beneath this is a formation of brown loam from four to five feet thick, containing a few angular flints; underneath this was a third bed composed of sandy marl from five to six feet thick, covered with a thin layer of angular gravel from one to two feet thick. In this bed, and eleven feet from the surface, was found a portion of an elephant's molar. The fourth bed, composed of partially rounded gravel, was from ten to fourteen feet thick, and in it the flint implements were chiefly found. Seventeen feet below the surface, and one foot above a flint hatchet, occurred the entire molar of a mammoth. Some of the flint implements have the shape of a spear-head, and are over seven inches in length. Evidently all these had been deposited during the formation of this bed. And it is not improbable that the tooth was taken from the skull of the animal by the hand that fashioned the flint.

In 1842, Mr. Godwin-Austen communicated to the Geological Society of London that he had examined Kent's Hole, Devonshire, and found human remains and works of art, such as arrow-heads and knives of flint, along with the remains of the mammoth and other extinct mammalia, and that the human remains and works of art were so placed that they could not be separated from those of the extinct fauna. These researches were conducted in the parts of the cave which had never been disturbed, and

* "Manual of the Antiquity of Man," pp. 34–38

remains were extracted beneath the thick covering of stalagmite.

At Brixham Cave many flint knives were found in the lower part of the ochreous cave-earth indiscriminately mixed with the bones of the mammoth and other extinct quadrupeds.

V. INTER-GLACIAL EPOCH.

The mammoth did not survive this period in Europe, save a few stragglers which continued for a short time in the Reindeer Epoch. It is probable that at a time corresponding to this epoch the *M. giganteus* flourished in America.

The remarkable discovery made by M. Lartet, in 1860, of human bones found in conjunction with those of certain extinct mammalia, including the mammoth, in the cave of Aurignac, situated in the arondissement of Saint-Gaudens, department of the Haute Garonne, France, has been fully described in the "Manual of the Antiquity of Man." It will be dismissed here with the statement that besides the human bones M. Lartet discovered flint instruments, and the relics there found represented different epochs; some of the implements and human bones dating back to the very beginning of the Mammoth Period in Europe.

VI. REINDEER EPOCH.

In May, 1864, M. Lartet, in exploring the cave of La Madeleine (France), discovered an outline sketch of the mammoth drawn on a slab of ivory. When found it was broken into five pieces, but afterwards was very accurately put together. A glance at Figure 8 will show that the artist has well depicted the small eye and the eccentric curvature of the tusks, as well as its huge trunk and abundant mane, the latter proving that it is really the mammoth. The erect tail, ending in a bunch of hair, also

separates it from the elephant, for the latter never sets up the tail, and has no bunch of hair at the end of it. Dr. Falconer was present when this discovery was made, and the skillful eye of this eminent palæontologist, accustomed to the study of the proboscidians, at once made out that its characteristics were the same as those of the mammoth of the Glacial Age. About the same time the Marquis Vibraye discovered on the banks of the Vesere, Dordogne (France), another engraving of the mammoth made on a slab of slate.

Fig 8.

Sketch of the Mammoth on Ivory from La Madeleine.

These ancient artists dealt in no fancy sketches and made no caricatures. They endeavored to outline the forms of animals and plants with scrupulous care. The sketches of the mammoth were not the result of blundering and careless artists, but were serious attempts to reproduce reality, and in executing these sketches they also must have seen the living animal. It is almost positive that these sketches date back to the beginning of the Reindeer Epoch, which would consequently give them an antiquity of not less than fifteen thousand years.

VII. ALLUVIUM.

Alluvium is the name generally given to the deposits of earth, sand, gravel, and other transported matter, made by running streams, especially during times of flood. It constitutes the flat lands on either side of the stream, and is usually in thin layers, owing to the amount that is successively deposited. These deposits have been many thousands of years in forming.

With the skeleton found by Dr. Koch, to which he gave the name *Missourium*, were several stone arrow-heads. One of these stone arrow-heads lay underneath and in contact with the thighbone of the skeleton, at a depth of fifteen feet. Near the skeleton, and fully as deep, were three other flint arrow-heads. This statement of Dr. Koch was contradicted by one of the men who assisted him in exhuming the skeleton.

About one year before this discovery (1839), Dr. Koch disinterred, in Gasconade county, Missouri, the charred remains of the *M. giganteus*. In a report to the St. Louis Academy of Sciences, he said: "The bones were sufficiently well preserved to enable me to decide positively that they belonged to the *M. giganteus*. Some remarkable circumstances were connected with the discovery. The greater portion of these bones had been more or less burned by fire. The fire had extended but a few feet beyond the space occupied by the animal before its destruction, and there was more than sufficient evidence on the spot that the fire had not been an accidental one, but on the contrary, that it had been kindled by human agency, and according to all appearance, with the design of killing the huge creature which had been found mired in the mud and in an entirely helpless condition. * * * All the bones which had not been burned by the fire had kept their original position, standing upright, and apparently quite undisturbed in the clay; whereas those portions which had been extended above the surface had been partially consumed by the fire, and the surface of the clay was covered, as far as the fire had extended, by a layer of wood-ashes, mingled with larger or smaller pieces of charred wood and burnt bones, together with bones belonging to the spine, ribs, and other parts of the body, which had been more or less injured by the fire. The fire appeared to have been most destructive around the head

of the animal. Some small remains of the head were left unconsumed, but enough to show that they belonged to the mastodon. There were also found, mingled with these ashes and bones, and partly protruding out of them, a large number of broken pieces of rock, which had evidently been carried thither from the shore of Bourbense River, to be hurled at the animal by its destroyers; for the above-mentioned layer of clay was entirely void even of the smallest pebbles; whereas, on going to the river I found the stratum of clay cropping out of the bank, and resting on a layer of shelving rocks of the same kind as the fragments; from which place, it was evident, they had been carried to the scene of action. The layers of ashes, etc., varied in thickness from two to six inches, from which it may be inferred that the fire had been kept up for some length of time. It seemed that the burning of the victim and the hurling of rocks at it, had not satisfied the destroyers, for I found also among the ashes, bones, and rocks, several arrow-heads, a stone spear-head, and some stone axes, which were taken out in the presence of a number of witnesses." The statement of Dr. Koch was received at first with contempt. During the last year of his life he was closely questioned by Dr. J. W. Foster concerning this discovery, when in the most solemn and emphatic manner he assured him that his statement was true.

The statement of Dr. Koch is not in the least incredible, in the light of more recent discoveries. It is further confirmed by the discovery on the 25th April, 1878, of the skeleton of a mastodon in Ashtabula county, Ohio. The remains consisted of the head, the atlas, twenty-five ribs, the scapula, several dorsal vertebræ, and three vertebræ of the coccyx, all in the middle of a muck swamp three and one-half feet below the surface. The bones had all the appearance of having been disturbed. Fragments of charcoal were distributed through the upper soil, and

some in the clay near the bones. About fifty feet from the skeleton, in the clay, an arrow-head was discovered at a depth of two and a half feet from the surface.

In the "Proceedings of the Philadelphia Academy of Natural Sciences," for July, 1859, Dr. Holmes, of Charleston, S. C., gives an account of his having found pottery at the base of a peat bog, on the banks of the Ashley River, in close connection with the grinder of a mastodon.

The existence of the mammoth or mastodon (probably the latter) was known to the people of Central America. On the walls of their stone-built palaces and temples have been found, engraven with elaborate care, the form of one of these animals. On one of the ruins at Palenque, State of Chiapas, Mexico, there is the figure of a head resembling the elephant, although the tusks are not represented.

Ancient basket works, matting, etc., were found on Petit Anse Island, Louisiana, at a depth of sixteen feet below the surface of the soil. Two feet above the matting were the remains of tusks and bones of the mastodon. The fossils, baskets, pottery, etc., belonged to a layer which rested upon a stratum composed of a gray mixture of salt, clay, and sand. Since the layer containing the remains was formed, fifteen others have been deposited, the greatest thickness of which is one hundred and eighty feet. The formation and position of the relics leave no doubt that man and the mastodon existed at the same time on this island. The bottom layer of this island is rock salt of unknown thickness, and the evidence shows that both man and the mastodon, as well as other animals, resorted to this place to obtain salt. The time or epoch to which these remains belong is uncertain. A more careful study of the formation is required.

The report of the Smithsonian Institute, for 1872, gives an illustration of an earth-work known as "The Big Elephant Mound." This illustration is reproduced in Fig. 9.

This mound is situated in Grant county, Wisconsin, eight miles below the mouth of Wisconsin River, and resting on the high sandy bottom-lands of the Mississippi, which slope gently to the river. The mound is described

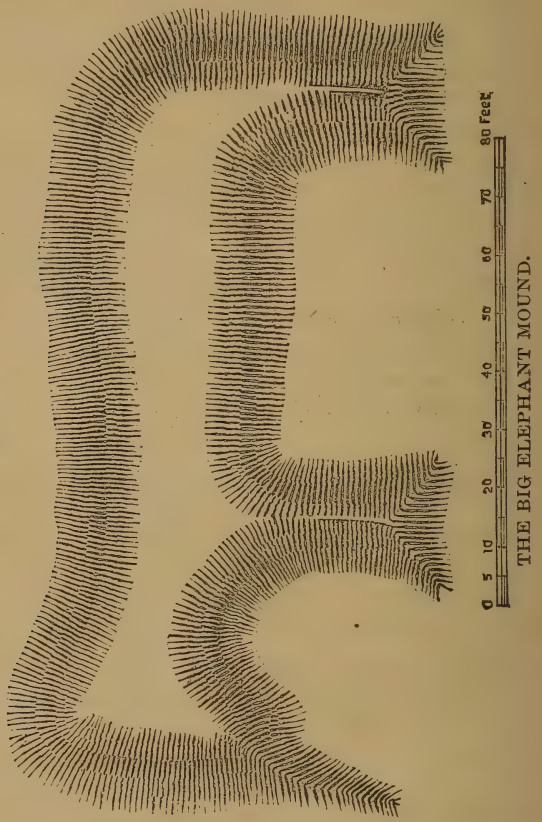


Figure 9. THE BIG ELEPHANT MOUND.

as having a total length of "one hundred and thirty-five feet; from hind feet to back, sixty feet; from fore feet to back, sixty-six feet; width across fore-legs, twenty-one feet; across hind-legs, twenty-four feet; from end of pro-

boscis or snout to neck or throat, thirty-one feet; space between fore and hind legs, fifty-one feet; from end of proboscis to fore legs, thirty-nine feet; across the body, thirty-six feet; general height of body above surrounding ground, five feet. The head is large and the proportions symmetrical." In the same section of country there are many mounds in the form of animals.

The existence of this mound does not establish the theory that the mastodon was here when the Mound-Builders flourished. No bones of any species of the elephant family have been found in the ancient monuments of the Mississippi Valley. The striking form of this family is not delineated on their pottery, as are those of all remarkable animals of the Valley. It is evident that the mammoth and its cousin, the mastodon, ceased to exist in the Valley long before it was occupied by the Mound-Builders. How then are we to account for the "Big Elephant Mound?" This mound may yet be the means of unraveling a portion of that mystery which surrounds this lost people. But the fact of the mound does not prove that the proboscidians still lived in the Valley when that mound was built. The Mound-Builders carried on an extensive commerce, as is shown by the material they used. They have figured tropical animals (the manatus or sea-cow, for instance) which show that they traversed other lands besides their own. If the mastodon lived in Central America during the time the Wisconsin mounds were erected, it is not unlikely that this mound was copied from the Central American animal; and if that be the case, then the last retreat of this animal is easily pointed out. Bradford, in his "American Antiquities," says "that a tomb, in the City of Mexico, upon being opened, was found to contain the bones of an entire mammoth, the sepulchre appearing to have been formed expressly for their reception." This would lead to the conclusion that these animals were held

to be sacred, and probably worshiped by the most ancient Mexicans. If this be true, then certain individuals were kept and cared for long after the species had virtually ceased to be. Then, upon this hypothesis, the traders, among the last remnants of the Mound-Builders in the North-West, may have seen, worshiped, and then produced the image of this animal.

VIII. TRADITION.

No tradition of the existence of the mammoth or mastodon has been preserved in Europe. In America there was a tradition among the Indians which was supposed to have referred to the mastodon. There are two accounts of this tradition, both of which are herewith given. The first is taken from Peale's pamphlet on the "Mammoth." "Ten thousand moons ago, when nought but gloomy forests covered this land of the sleeping sun; long before the pale men, with thunder and fire at their command, rushed on the wings of the wind to ruin this garden of nature; when nought but the untamed wanderers of the woods, and men as unrestrained as they were the lords of the soil; a race of animals existed, huge as the frowning precipice, cruel as the bloody panther, swift as the descending eagle, and terrible as the angel of night. The pines crashed beneath his feet, and the lake shrunk when they slaked their thirst; the forceful javelin in vain was hurled, and the barbed arrow fell harmless from their side. Forests were laid waste at a meal; the groans of expiring animals were everywhere heard, and whole villages, inhabited by men, were destroyed in a moment. The cry of universal distress extended even to the region of peace in the West, and the good Spirit interposed to save the unhappy. The forked lightning gleamed around, and loudest thunder rocked the globe! The bolts of heaven were hurled upon the cruel destroyers alone, and the mountains echoed with the bel-

lowing of death. All were killed except one male, the fiercest of the race, and him, even the artillery of the skies assailed in vain. He ascended the bluest summit which shades the source of the Monongahela, and, roaring aloud, bid defiance to every vengeance. The red lightning scorched the lofty firs, and rived the knotty oaks, but only glanced upon the enraged monster. At length, maddened with fury, he leaped over the waves of the west at a bound, and this moment reigns the uncontroled monarch of the wilderness, in despite even of Omnipotence itself."

While the ideas of this tradition may be essentially Indian, the language is certainly English and highly colored. The second account is taken from volume eight of "Jefferson's Works." "In ancient times a herd of these tremendous animals came to the Big-Bone licks, and began an universal destruction of the bear, deer, elks, buffaloes, and other animals which had been created for the use of the Indians; that the Great Man above, looking down and seeing this, was so enraged that he seized his lightning, descended on the earth, seated himself on a neighboring mountain, on a rock of which his seat and the print of his feet are still to be seen, and hurled his bolts among them till the whole were slaughtered, except the big bull, who, presenting his forehead to the shafts, shook them off as they fell; but missing one at length, it wounded him in the side; whereon, springing round, he bounded over the Ohio, over the Wabash, the Illinois, and finally over the great lakes, where he is living at this day."

It is mere assumption to claim that this tradition refers to the mastodon. Some regard it as more probable that the Great Buffalo was intended,—the remains of this animal has been met with in Kentucky and elsewhere. However, little credence can be attached to Indian traditions. They are notoriously superstitious and invent stories or legends which they attach to almost any unusual circum-

stance, and, after the lapse of a few generations, the legend becomes so distorted that its real application is lost. They possessed no tradition whatever of the expedition of De Soto to the Mississippi; and yet it was attended with just such circumstances—horses, fire-arms, etc.—as would seem to fix itself upon the minds of the savages.

APPENDIX.

Dimensions of the skeletons of the *Mastodon Giganteus* described by Dr. J. C. Warren and Rembrandt Peale:

FIRST.—THAT DESCRIBED BY DR. WARREN.

	Ft.	In.
Height of skeleton	11	
Length to the base of tail	17	
Circumference of trunk around the ribs	16	5
Length of tail	6	8
" trunk (or body)	10	3
" head from occipital condyles in a straight line to anterior edge of socket	3	2
Tusk—Entire length	10	11
Depth of socket	2	3
External length	8	8
Entire length of skeleton, including tusks	25	
Probable height when alive	13	

SECOND.—THAT DESCRIBED BY REMBRANDT PEALE.

Height over shoulders	11	
" " hips	9	
Length from chin to the rump	15	
From the point of the tusks to the end of the tail, following the curve	31	
Length in a straight line	17	6
Width of the hips and body	5	8
Length of the under jaw	2	10
Weight of the same, sixty-three and a half pounds.		
Width of the head	3	2

Length of the thigh-bone	3	7
Smallest circumference of the same	1	6
Length of the tibia	2	
" " humerus	2	10
Largest circumference of the same	3	2½
Smallest " " "	1	5
Length of radius	2	5½
" scapula	3	1
" longest vertebræ	2	3
Longest rib without cartilage	4	7
Length of the first rib	2	
" " breast-bone	4	
" " tusks	10	7
Circumference of one tooth or grinder	1	6½

Weight of same, four pounds ten ounces.

Weight of the whole skeleton about 1,000 pounds.

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